

THE PRESERVATION OF ANATOMICAL MATERIAL
BY CARBOLIC ACID.*

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Recently Professor Mall,† in another of his excellent articles on the preservation of dissecting material, inclines to the use of vats containing a solution of carbolic acid for storage of cadavers. An underground cemented room to hold the bodies is being constructed at the Johns Hopkins Anatomical Laboratory and the writer says: "In case cadavers can be kept indefinitely in a 3% solution of carbolic acid, I see no reason why our cold-storage apparatus should be replaced when it is worn out."

This means that a body properly embalmed will not be affected by the temperature of the air and if kept moist and the surface aseptic will be suitable for dissection for an indefinite period.

Storage in vats instead of in the refrigeration apparatus, I understand from the paper, was largely the outcome of experiments undertaken to preserve the skin, which is indeed a difficult matter. Immersion of the body in a 3 per cent carbolic acid solution was found to preserve the skin best just as injections into the vessels of 3 per cent of the acid to the body weight gave the most satisfactory results in the general embalming. "It was found that cadavers which were evenly embalmed, epidermis included, with a 3% solution of carbolic acid and wrapped with carbolized vaseline could be kept upon an open shelf in a warm room at Baltimore for at least six months and still be perfectly good for dis-

* Reprinted from the Quarterly Bulletin Medical Department Washington University, Vol. IV, No. 1. Aug. 1905.

† Mall, Franklin P. Anatomical Material — Its Collection and its Preservation at the Johns Hopkins Anatomical Laboratory. Bulletin of the Johns Hopkins Hospital, Vol. XVI, Feb. 1905.

section. * * * It should be possible to keep them indefinitely in an aseptic room with an atmosphere saturated with moisture."

Our own experience in preserving dissecting material with carbolic acid began after the publication of Mall's paper in 1896,* and it is with much interest and satisfaction to find that the experiments made by us since then are along the same lines and the results the same as those at the Johns Hopkins Laboratory as shown in Mall's last account.

We first made experiments to determine under what conditions material must be kept after it had been injected with a mixture of equal parts of carbolic acid, glycerine and alcohol. Dogs were used and it was soon found that when left in the open air no decomposition occurred except in the legs of some of them; drying more or less extensive took place in all. One dog by accident was left unnoticed on a fire-escape from November until August, exposed to the elements; except that it was somewhat dry and that the soft parts of the legs were partly destroyed by dermestes, it was in good condition and could have been dissected.

These results led us to try to reduce the problem of preserving dissecting material from one where both embalming and special methods of storing were necessary to one where embalming alone would give the desired results. It was our aim to embalm the bodies so well that they would last, if protected from evaporation, lying out upon a shelf and so to dispense with cold storage and vats. With carbolic acid as the preservative we believed that this could be accomplished.

Our attention was early directed to finding the cause of the imperfect preservation of the extremities which happened in the human bodies as well as in the dogs. The mixture of equal parts

* Mall, F. P. The Anatomical Course and Laboratory of the Johns Hopkins University. Bulletin of the Johns Hopkins Hospital, Vol. VII, 1896, p. 85.

of carbolic acid and alcohol makes a heavy fluid which runs rather slowly especially in cold weather, a circumstance that helps to retard the free passage to the legs and feet. When the proportion of glycerine was lessened and the alcohol increased the flow was improved but the body became correspondingly harder. Better penetration of the original mixture was obtained when we put in an air-pressure apparatus like that at the Johns Hopkins Laboratory. Still there are some advantages in using the slow process of siphonage and this method has not been entirely discarded by us.

The place selected for injection was first the carotid artery but, as Mall found, the fluid would lodge in the viscera, the abdomen and chest would distend and not enough of the acid reach the extremities to preserve them.

The large branches of the abdominal aorta take up the fluid coming down that vessel in such quantity that the abdomen begins to be distended before much of it reaches the legs. I am inclined to think that the flow into the femoral artery is hindered in the dead body by pressure, as the abdomen fills, of surrounding parts in the neighborhood of Poupart's ligament.

This unequal distribution can be prevented by bandaging the abdomen and chest from the pubis to the axilla before injecting, a method practiced by Dr. Blair who had been filling the vessels with an aqueous fluid under great pressure. Binding the abdomen is not always successful, however, in causing the vessels in the extremities to fill and it sometimes becomes necessary to inject separately the extremities and rarely even the hands and feet.

In order to make the embalming fluid reach the extremities where bandaging of the abdomen failed, I devised a little canula which can be pushed into an artery and far along it. The canula directs the fluid in advance of itself and at the same time acts as an obturator preventing a backward flow. No tying is required so that there is a minimum disturbance of parts at the place of

insertion. The canula can be put into the femoral artery in Scarpa's triangle and shoved nearly to the end of the popliteal at which point injection of the leg begins.

Unequal distribution of the carbolic mixture we found to be due in many instances to plugged arteries, a condition we cannot always remedy by injection for the plugs are often long and branched. In such cases Keiller* injects subcutaneously and into fascial compartments supplied by the plugged artery, using a large hypodermic needle.

After taking the precaution to bandage the chest and abdomen and then if necessary to inject the extremities separately we have been successful in saving bodies with carbolic acid in excellent condition for dissection for more than a year, keeping them in neither cold storage nor in vats, but placing them on shelves in a closed room at the usual temperatures of St. Louis and protected only against evaporation.

Our method of preserving the skin is essentially the same as that employed by Professor Mall, except that we have used a 10 per cent formaline bath instead of 3 per cent carbolic acid. When a cadaver is received it is put into a tank containing 10 per cent formaline and left twenty-four hours. This fixes the epidermis and the formaline penetrates sufficiently to enter the deeper layers of the skin. Afterwards the body is embalmed with the carbolic acid mixture. It seems to me that the use of the carbolic acid bath is to be preferred to formaline; it is less objectionable to work with and being a preservative that diffuses well it has given good results.

Upon the property of extensive diffusion of carbolic acid, which Mall mentions, depends our success in the preservation of autopsy bodies; while extremities and head are the only parts injected, yet the trunk is saved by having the cavities stuffed, after the

* Keiller, William. On the Use of Formaline in the Dissecting Room. Philadelphia Medical Journal, Vol. VI, Dec. 29, 1900, p. 1248.

removal of the viscera, with a cotton cloth soaking wet in the carbolic acid mixture. When the cloth is tucked in between the ribs and the common skin and muscle flap and the median incision sutured, the abdominal and chest walls and muscles of the back are thoroughly saturated with the preservative. Autopsy cadavers are in fact better preserved than entire bodies.

Since 1899 we have not used cold storage rooms or solutions for storing our material.

The statistical paper of Grönroos* shows that in the year 1898 the majority of continental medical schools were using carbolic acid in some mixture, usually with glycerine and alcohol, as an injection and were storing the embalmed material in tanks containing various preserving fluids. In America the tendency to store in cold vaults began and several institutions have followed Huntington and Mall in establishing refrigerating machines. The initial expense of cold storage apparatus and its subsequent care are obstacles to this method of storage for unendowed schools, while the ordinary ice-box is unsatisfactory in many respects in addition to being expensive.

The results of our experiments with carbolic acid have from the start indicated that storage is a secondary matter compared with embalming and this has been demonstrated at Johns Hopkins where a cadaver properly embalmed and kept upon an open shelf in a warm room for half a year "cannot be detected from others by its quality and appearance." Our experience is the same and we can say that when a body is thoroughly saturated with carbolic acid it is well embalmed and with the epidermis fixed the only matter that calls for attention in storage is the drying of the body. When a body is smeared with vaseline, wrapped with paper and then in an oil-skin but little drying ensues; what evap-

* Grönroos, Hjalmer. Zusammenstellung der üblichen Konservierungsmethoden für Präparirsaalzwecke. Anatomischer Anzeiger, Bd. 15, 1898; p. 61.

oration does take place we think is largely by the mouth and nose when these are not sealed.*

A number of years ago Dr. Todd, of this city, stored bodies in an ice-box covering them with cedar sawdust which had been moistened with a solution of carbolic acid. These bodies did not dry and we are considering storing our material in a small room covered in the same way. This process offers some advantages in its simplicity and cleanliness over the method of wrapping in vaseline and oil-skin.

The use of tanks for storage has never appealed to us much largely on account of the difficulty in keeping the solutions clean and free from mould and because of the disagreeable features attending the handling of the material. So simple, clean and effective a fluid as 3 per cent carbolic acid which Professor Mall is using is, however, a strong inducement to go from the dry to the wet method of storing.

* Mucous membranes are dry in bodies preserved in carbolic acid which is a matter for regret. The mouth and nose should be stuffed with tow soaked in glycerine and the lips stitched together. Dr. Blair has found that the introduction into the urethra of a cotton wick soaked in paraffine will keep the canal in a condition to allow subsequently the passage of a sound.

